



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

Address: COMMISSIONER FOR PATENTS

P.O. Box 1450

Alexandria, Virginia 22313-1450

www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/541,184	07/01/2005	Akihiko Namba	039.0050	4938
29453	7590	03/28/2008		
Judge Patent Associates Dojima Building, 5th Floor 6-8 Nishitemma 2-Chome, Kita-ku Osaka-Shi, 530-0047 JAPAN				
EXAMINER				
SINGAL, ANKUSH K				
ART UNIT		PAPER NUMBER		
2823				
MAIL DATE		DELIVERY MODE		
03/28/2008		PAPER		

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

### Office Action Summary

**Application No.**

10/541,184

**Applicant(s)**

NAMBA ET AL.

**Examiner**

ANKUSH K. SINGAL

**Art Unit**

2823

**Period for Reply** -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 18 February 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-9 is/are pending in the application.
- 4a) Of the above claim(s) 5 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-4 and 6-9 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/CDC)
- 4) ☐ Interview Summary (PTO-413)
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_
- Paper No(s)/Mail Date \_\_\_\_\_

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on February 18, 2008 has been entered.

### ***Claim Objections***

2. Claim 1 objected to because of the following informalities: Please complete the sentence after "...implanting Li ions into..." in line 3 of claim 1. Appropriate correction is required.

### ***Claim Rejections - 35 USC § 103***

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 1-4 and 6-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over A.M.Zaitsev(Optical properties of Diamond- A data Handbook 2001) .

Re. claim 1, Zaitsev discloses a method of manufacturing n-type semiconductor diamond, comprising: a step of producing diamond incorporating Li and N by implanting Li ions and a step of annealing said diamond incorporating Li and N(Page 265).

However Zaitsev does not teach the Lithium and Nitrogen ions to be 10ppm and single crystal diamond incorporating at least 10ppm N; and annealing temperature to be between 800.degree. C. to less than 1800.degree. C under high-pressure conditions of at least 3 GPa and diamond has a sheet resistance of not greater than 10.<sup>sup.7</sup> .OMEGA./quadrature , but Zaitsev also discloses that the annealing behavior depends on the type of diamond and irradiation conditions(Page 265). However Zaitsev disclosure for given conditions of the claimed invention, the claim range is considered to be an obvious matter of finding an optimum workable range for some chosen design requirement utilizing Zaitsev method.

Note that it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves routine skill in the art. In re Aller, 105 USPQ 233.

Any difference in the claimed invention and the prior art may be expected to result in some differences in properties. The issue is whether the properties differ to such an extent that the difference is really unexpected. In re Merck & Co.,800 F.2d 1091,231 USPQ 375 (Fed. Cir. 1986)

Re. claim 2, Zaitsev discloses a method of manufacturing n-type semiconductor diamond, comprising: a step of producing diamond incorporating Li and N by implanting

Art Unit: 2823

into single-crystal diamond essentially not containing impurities Li and N ions and the annealing step of diamond incorporating Li and N.

However, Zaitsev does not teach that the ion-implantation depths at which the post-implantation Li and N concentrations each are at least 10 ppm or more will overlap; and a step of annealing at a temperature in range of from 800.degree. C. to less than 1800.degree. C, under high -pressure conditions of at least 3 GPa and diamond has a sheet resistance of not greater than  $10 \cdot \sup{7} \cdot \text{OMEGA} / \text{quadrature}$ . However Zaitsev disclosure for given conditions of the claimed invention, the claim range is considered to be an obvious matter of finding an optimum workable range for some chosen design requirement utilizing Zaitsev method.

Note that it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves routine skill in the art. In re Aller, 105 USPQ 233.

Any difference in the claimed invention and the prior art may be expected to result in some differences in properties. The issue is whether the properties differ to such an extent that the difference is really unexpected. In re Merck & Co., 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986)

Re. claim 3, Zaitsev discloses all the limitations including implantation of Li and N in diamond and then annealing but does not teach a step of implanting the ions so that ion-implantation depths at which the post-implantation Li and N concentrations each are at least 10 ppm will overlap, and so that the Li and N sum-total dose is less than or equal to  $5.0 \times 10^{15} \text{ cm}^{-2}$  and annealing temperature to be between  $800^\circ\text{C}$  to less than  $1800^\circ\text{C}$  under high-pressure conditions of at least 3 GPa and diamond has a sheet resistance of not greater than  $10^7 \text{ } \Omega/\text{square}$ . However Zaitsev disclosure for given conditions of the claimed invention, the claim range is considered to be an obvious matter of finding an optimum workable range for some chosen design requirement utilizing Zaitsev method.

Note that it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves routine skill in the art. In re Aller, 105 USPQ 233.

Any difference in the claimed invention and the prior art may be expected to result in some differences in properties. The issue is whether the properties differ to such an extent that the difference is really unexpected. In re Merck & Co., 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986)

Art Unit: 2823

Re. claim 4 as discussed above in claim 3, Zaitsev discloses all the limitations as discussed above in claim 1 except ion-implantation apparatus having an electron-beam line and two ion-beam lines is utilized to implant the Li and N ions simultaneously while radiating with the electron beam the single-crystal diamond that is ion-implanted, but Zaitsev also teaches that the implantation apparatus depends on the type of diamond used. However Zaitsev disclosure for given conditions of the claimed invention, the claim range is considered to be an obvious matter of finding an optimum workable range for some chosen design requirement utilizing Zaitsev method.

Note that it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves routine skill in the art. In re Aller, 105 USPQ 233.

Any difference in the claimed invention and the prior art may be expected to result in some differences in properties. The issue is whether the properties differ to such an extent that the difference is really unexpected. In re Merck & Co., 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986)

Re. claim 6, Zaitsev discloses the Semiconductor diamond being n-type, but does not teach incorporating, from a crystal face thereof to the same depth, at least 10 ppm of each of Li and N, and having a sheet resistance of not greater than 10.<sup>sup.7</sup>



.OMEGA./quadrature. or less. However Zaitsev disclosure for given conditions of the claimed invention, the claim range is considered to be an obvious matter of finding an optimum workable range for some chosen design requirement utilizing Zaitsev method.

Note that it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves routine skill in the art. In re Aller, 105 USPQ 233.

Any difference in the claimed invention and the prior art may be expected to result in some differences in properties. The issue is whether the properties differ to such an extent that the difference is really unexpected. In re Merck & Co., 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Re. claim 7 as discussed above in claim 2, ZaisteV discloses all the limitations as discussed above in claim in claim 2 except the diamond is either Type IIa or undoped epitaxial diamond; the Li ions are implanted at a dose of at least  $3.0 \times 10^{15} \text{ cm}^{-2}$  and the N ions at a dose such that the Li and N sum-total dose is at least  $7.0 \times 10^{15} \text{ cm}^{-2}$ ; and the Li and N ion concentrations where the ion-implantation depths overlap each are at least 1600 ppm. However, ZaisteV teaches that the process of manufacturing n-type diamond depends on the type of diamond and irradiation conditions. However Zaitsev disclosure for given conditions of the claimed invention, the claim range is considered to

be an obvious matter of finding an optimum workable range for some chosen design requirement utilizing Zaitsev method.

Note that it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves routine skill in the art. In re Aller, 105 USPQ 233.

Any difference in the claimed invention and the prior art may be expected to result in some differences in properties. The issue is whether the properties differ to such an extent that the difference is really unexpected. In re Merck & Co., 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Re. claim 8 as discussed above in claim 3, Zaisteve discloses all the limitations as discussed above in claim 3 except the diamond is either Type IIa or undoped epitaxial diamond; in said implanting step the Li ions are implanted at a dose of at least  $3.0 \times 10^{15} \text{ cm}^{-2}$  and the N ions at a dose such that the Li and N sum-total dose is at least  $7.0 \times 10^{15} \text{ cm}^{-2}$ , and the Li and N ion concentrations where the ion-implantation depths overlap each are at least 1600 ppm. However, Zaisteve teaches that the process of manufacturing n-type diamond depends on the type of diamond and irradiation conditions. However Zaitsev disclosure for given conditions of the claimed invention, the claim range is considered to be an obvious matter of finding an optimum workable range for some chosen design requirement utilizing Zaitsev method.

Note that it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves routine skill in the art. In re Aller, 105 USPQ 233.

Any difference in the claimed invention and the prior art may be expected to result in some differences in properties. The issue is whether the properties differ to such an extent that the difference is really unexpected. In re Merck & Co., 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Re. claim 9 as discussed above in claim 6, Zaistevev discloses all the limitations as discussed above in claim 6 except the diamond is either Type IIa or undoped epitaxial diamond; the concentration at which Li and N overlap to the same depth is at least 1600 ppm; and the sheet resistance is not greater than 1.4 times. 10.sup.7 .OMEGA./quadrature. However, Zaistevev teaches that the process of manufacturing n-type diamond depends on the type of diamond and irradiation conditions. However Zaitsev disclosure for given conditions of the claimed invention, the claim range is considered to be an obvious matter of finding an optimum workable range for some chosen design requirement utilizing Zaitsev method.

Note that it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves routine skill in the art. In re Aller, 105 USPQ 233.

Any difference in the claimed invention and the prior art may be expected to result in some differences in properties. The issue is whether the properties differ to such an extent that the difference is really unexpected. In re Merck & Co., 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ankush k. Singal whose telephone number is 5712701204. The examiner can normally be reached on monday-friday 7am-5pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, MATTHEW SMITH can be reached on (571)272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Khiem D. Nguyen/  
Examiner, Art Unit 2823

Ankush Singal